Introduction to special section: The MaCWAVE-MIDAS Program to Study the Polar Summer Mesosphere

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Received 19 October 2004; accepted 26 October 2004; published 16 December 2004.

INDEX TERMS: 0350 Atmospheric Composition and Structure: Pressure, density, and temperature; 0394 Atmospheric Composition and Structure: Instruments and techniques; 3314 Meteorology and Atmospheric Dynamics: Convective processes; 3332 Meteorology and Atmospheric Dynamics: Mesospheric dynamics; 3334 Meteorology and Atmospheric Dynamics: Middle atmosphere dynamics (0341, 0342). **Citation:** Goldberg, R. A., and D. C. Fritts (2004), Introduction to special section: The MaCWAVE-MIDAS Program to Study the Polar Summer Mesosphere, *Geophys. Res. Lett.*, *31*, L24S01, doi:10.1029/2004GL021789.

[1] Gravity waves provide the dominant forcing of the mesosphere-lower thermosphere (MLT) region under solstice conditions via energy and momentum transports from lower altitudes and their dissipation in the MLT. Despite this, the quantitative aspects of this forcing are poorly understood at present. The MaCWAVE/MIDAS collaborative rocket and ground-based measurement programs were performed at the Andøya Rocket Range (69.3°N) and the nearby ALOMAR observatory in northern Norway during July 2002 to address this question. The summer component of the MaCWAVE (Mountain and Convective Waves Ascending Vertically) program was focused on gravity wave propagation, instability, and wave-wave and wave-mean flow interaction dynamics contributing to summer mesopause structure and variability. The MIDAS (Middle Atmosphere Dynamics and Structure) program concentrated on small-scale dynamical and microphysical processes near the summer mesopause. The merged program yielded a comprehensive data set comprising two ~12-hour rocket salvos, including 25 MET rockets and 5 sounding rockets, ground-based lidar, radar, and balloon data, and coordinated overpasses of the TIMED satellite.

[2] Interesting items addressed in this special section include evidence for a lower and weaker residual (vertical and meridional) circulation, lower closure of the mesospheric jet, a colder middle mesosphere and warmer mesopause, and smaller occurrence frequencies of polar mesosphere summer echoes (PMSE) and noctilucent clouds (NLC) during the summer of 2002 than under more typical summer conditions. These aspects of the summer mesopause environment were linked to unusual small- and large-scale dynamics during this period. Rocket-borne and ground-based instrumentation provided evidence of stronger than normal gravity wave activity throughout the MLT, the occurrence of significant turbulence at much lower altitudes than observed previously, and extreme gradients of wind and temperature in the lower thermosphere. Measurements of the small-scale electron structure showed that the neutral turbulence was reflected in the plasma, except within regions where charged icy particles were present. Other analyses quantified the character and propagation of small- and large-scale waves throughout the atmosphere, while a study employing a general circulation model demonstrated how the unusual mean state and the unusual small- and large-scale wave dynamics may have been linked. Together, these data suggest influences of planetary wave dynamics in the southern winter hemisphere on the polar summer MLT that were not anticipated. The ordering of the papers included in this section is designed to take the reader from mean effects in time and influences on a global scale to a closer view of processes occurring in local time and space.

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0094-8276/04/2004GL021789